

Claims 1-2, and 4-10 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Yoshifumi in view of U.S. Patent 5,551,662 to Tanimoto et al.

First, Applicants wish to thank Examiner Addison for the April 2, 2002 personal interview at which time the outstanding issues in this case were discussed. During the interview, amendments and arguments substantially as indicated in this response were discussed. While no agreement was reached, the Examiner indicated that such amendments and arguments may overcome Yoshifumi.

With regard to the objection to the drawings, submitted herewith is a separate letter requesting approval of drawing changes, such changes designating Figures 9-14 as "Prior Art". Upon receiving approval for the letter requesting approval of drawing changes, Applicants will submit formal drawings including such changes. Therefore, the objection to the drawings is believed to be overcome.

Turning now to the merits, Applicants' invention is directed to a permanent magnet motor and a method of manufacturing such a motor. Conventional permanent magnet motors have been problematic in that they have been unable to achieve an efficient motor having both reduced cogging torque and reduced vibration noise in a single motor design. Applicants' invention is directed to overcoming this problem.

Specifically, Applicants' Claim 1, as amended, recites a permanent-magnet motor having a stator, and a rotor facing to inside of the stator across a gap part, and having a rotor core and a permanent magnet provided to the rotor core.

The permanent magnet is made so as to have both of a convex part to an inner diameter side and a convex part to an outer diameter side, a focus of magnetic orientation of each magnetic pole of the permanent magnet is located outside of the rotor. Also recited is that the rotor is formed by a rotor core assembly made by multilayering multiple pieces of

core laminations, each having plural containing holes for inserting the permanent magnets and the permanent magnets are inserted into the containing holes for inserting the permanent magnets, and a thickness of the rotor core, which separates the permanent magnet and the gap, is made within $\pm 30\%$ of a thickness of the rotor core lamination.

As described in Applicants' specification, a permanent magnet having both a convex part to an inner diameter side and a convex part to an outer diameter side, as well as a thickness of the rotor core that separates the permanent magnet and the gap being made within $\pm 30\%$ of the thickness of the rotor core lamination provides the unexpected result of a highly efficient motor having reduced cogging torque and reduced vibration in a single motor design.¹ The reference to Yoshifumi discloses a motor structure that apparently includes both the convex inner and outer part of the permanent magnet. However, as discussed in the April 2, 2002 interview, the Yoshifumi reference does not disclose a thickness of the rotor core that separates the permanent magnet and the gap being made within $\pm 30\%$ of the thickness of the rotor core lamination. Moreover, as the Tanimoto et al reference discloses a permanent magnet having only a convex part to the inner diameter side of the motor, this reference also does not disclose the limitation of $\pm 30\%$ of a thickness of the rotor core lamination. Indeed, the Yoshifumi and Tanimoto et al references do not discuss any range of thickness or any importance to the thickness of the rotor core at a position between the convex part to the outer diameter and the air gap. Therefore, Claim 1 patentably defines over these prior art references.

Applicants also note that Claim 9 has been amended to include the method step of forming a rotor core assembly such that a thickness of the rotor core that separates the

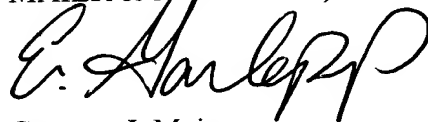
¹See Applicants' specification at page 8, lines 6-13; page 8, line 25 - page 9, line 5; page 10, lines 1-3.

permanent magnet and the gap part is made within $\pm 30\%$ of the thickness of the multiple rotor core laminations. Thus, Claim 9 patentably defines over the cited references for the reasons stated above with respect to Claim 1. Finally, as Claims 3-8 depend from Claim 1, these claims also patentably define over the cited references.

Consequently, in view of the present amendment, no further issues are believed to be outstanding in the present application and the present application is believed to be in condition for formal Allowance. An early and favorable action is therefore respectfully requested.

Respectfully submitted,

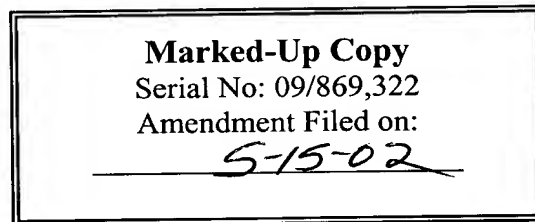
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IN THE CLAIMS

--1. (Amended) A permanent-magnet motor comprising:

a stator having stator winding of plural phases; and

a rotor facing to inside of the stator across a gap part, and having a rotor core and a permanent magnet provided to the rotor core,

wherein the permanent magnet is made so as to have both of a convex part to an inner diameter side and a convex part to an outer diameter side in a cross section taken vertically to an axis; [and]

wherein a focus of magnetic orientation of each magnetic pole of the permanent magnet is located outside of the rotor,

wherein the rotor is formed by a rotor core assembly made by multilayering multiple pieces of core laminations, each having plural containing holes for inserting the permanent magnets and the permanent magnets are inserted into the containing holes for inserting the permanent magnets; and

wherein a thickness of the rotor core, which separates the permanent magnet and the gap, is made within $\pm 30\%$ of a thickness of the rotor core lamination.

2. (Canceled).

4. (Amended) The permanent-magnet motor of claim 1, [wherein a containing hole is provided to the rotor core for inserting the permanent magnet; and]

wherein when a radius of an arc of an outer diameter side of the containing hole is R , and a radius of an arc of an outer diameter side of the permanent magnet inserted into the containing hole is r , it is set as $R < r$.

8. (Amended) A permanent-magnet motor comprising:

a stator having stator winding of plural phases; and

a rotor facing to inside of the stator across a gap part, and having a rotor core and a permanent magnet provided to the rotor core, [and]

wherein the permanent magnet is made so as to have both of a convex part to an inner diameter side and a convex part to an outer diameter side in a cross section taken vertically to an axis,

wherein the rotor is formed by a rotor core assembly made by multilayering multiple pieces of core laminations, each having plural containing holes for inserting the permanent magnets and the permanent magnets are inserted into the containing holes for inserting the permanent magnets; and

wherein a thickness of the rotor core, which separates the permanent magnet and the gap, is made within $\pm 30\%$ of a thickness of the rotor core lamination.

9. (Amended) A method for manufacturing a permanent-magnet motor including a stator having stator winding of plural phases and a rotor facing to inside of the stator across a gap part, and having a rotor core and a permanent magnet provided to the rotor core, the method comprising:

making the permanent magnet so as to have both a convex part to an inner diameter side and a convex part to an outer diameter side in a cross section taken vertically to an axis

forming a rotor core assembly by multilayering multiple rotor core laminations, each having plural containing holes for inserting the permanent magnets; and

inserting the permanent magnets into the plural containing holes for inserting the permanent magnets.

wherein a thickness of the rotor core, which separates the permanent magnet and the gap part, is made within $\pm 30\%$ of a thickness of the multiple rotor core laminations.

Claim 10 (Canceled).